

DaimlerChrysler AG

Patent Claims

- 5 1. A belt tensioning unit of a seat belt (1), which
can be retracted on a belt reel (4), for an occupant on
a seat in a vehicle, in particular motor vehicle, with
- a return device (6), which is connected in terms
of drive to the belt reel, for the automatic
10 shortening of the belt,
 - an extension lock (5) of the belt, which extension
lock is effective at predetermined parameters, in
particular at a predetermined deceleration or
acceleration of the vehicle or of its body and/or
15 when a predetermined extension speed of the belt
is exceeded,
 - a sensor system which is capable of recognizing
potentially dangerous and/or accident-prone
driving situations, and
 - 20 - a reversible clamping device (8), which interacts
with the sensor system and can be driven by means
of an associated motor (9), the motor (9) of which
clamping device drives the belt reel (4) in the
clamping direction of the belt as a function of
25 signals of the sensor system and sets an increased
belt tension, characterized in that a two-path
transmission (10) is arranged between the motor
(9) of the reversible clamping device (8) and the
belt reel (4), the paths of which transmission
30 have different transmission ratios with
correspondingly different intensification of the
torque on the belt reel in comparison to the motor
torque.
- 35 2. The belt tensioning unit as claimed in claim 1,
characterized in that the two-path transmission can be
switched over by reversing the direction of rotation of
the motor (9), and the belt reel (4) rotates relative

to the motor in one direction of rotation when the one path is switched on and in the opposite direction of rotation when the other path is switched on.

- 5 3. The belt tensioning unit as claimed in claim 2, characterized in that the paths can be switched on by two freewheels (15, 17; 23, 26), of which the one locks in the one direction of rotation and the other locks in the other direction of rotation of the motor.
- 10
4. The belt tensioning unit as claimed in claim 3, characterized in that the two-path transmission is designed as a planetary transmission.
- 15 5. The belt tensioning unit as claimed in claim 4, characterized in that the first freewheel (15) is arranged between a stationary part (16) and the planet carrier (14) of the planetary transmission.
- 20 6. The belt tensioning unit as claimed in claim 4 or 5, characterized in that the second freewheel (17) is arranged between planet carrier (14) and sun wheel (12) of the planetary transmission.
- 25 7. The belt tensioning unit as claimed in claim 3, characterized in that the transmission is designed as a cylindrical transmission with paths arranged in two radial planes at a distance from each other axially.
- 30 8. The belt tensioning unit as claimed in claim 7, characterized in that the first freewheel (23) is arranged in one radial plane between motor shaft (20) and a gearwheel (22) arranged thereon.
- 35 9. The belting tensioning unit as claimed in claim 7 or 8, characterized in that the second freewheel (26) is arranged in the other radial plane between motor shaft (20) and a gearwheel (25) arranged thereon.

10. The belt tensioning unit as claimed in one of claims 2 to 9, characterized in that there is a rotational clearance between a motor-side part of the input of the transmission (10) and the transmission
5 output, and in that a slipping clutch (30', 30'') is arranged between input and output, via which slipping clutch the transmission output can be driven within the abovementioned clearance in the forward or backward direction depending in each case on the direction of
10 rotation of the transmission input.

11. The belt tensioning unit as claimed in claim 1, characterized in that between input and output of the two-path transmission (10) there is firstly arranged a
15 direct frictional connection (37) and secondly an interlocking drive train (35, 39, 40, 41), which is stepped down in comparison to the frictional connection and, when the output moves in a direction of movement associated with the clamping direction of the belt reel
20 (4), is free from inevitably being coupled in the direction of the input.

12. The belt tensioning unit as claimed in claim 11, characterized in that the interlocking drive train is
25 designed to be self-locking in relation to the transmission of force from the output to the input.

13. The belt tensioning unit as claimed in claim 12, characterized in that, in the interlocking drive train,
30 an input worm (40) interacts with an output worm wheel (41).

14. The belt tensioning unit as claimed in one of claims 11 to 13, characterized in that the direct
35 frictional connection is designed as a slipping clutch (37).

15. The belt tensioning unit as claimed in one of
claims 10 to 14, characterized in that a clutch (31) is
arranged between transmission output and belt reel (4),
said clutch opening and closing as a function of the
5 direction of rotation of its transmission side.

16. The belt tensioning unit as claimed in one of
claims 1 to 14, characterized in that a clutch (31)
which can be actuated by external power, in particular
10 electrically, is arranged between transmission output
and belt reel (4).